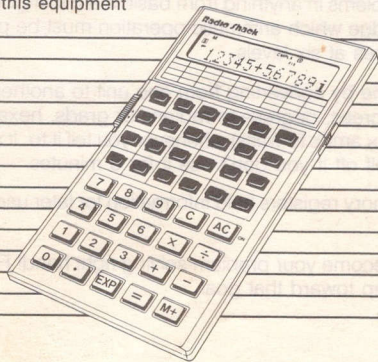# EC-4035
ENGINEERING
SCIENTIFIC CALCULATOR

OWNER'S MANUAL

Please read before using this equipment

Cat. No. 65-983

Radio Shack®

INTRODUCTION

Your new Radio Shack EC-4035 Engineering Scientific Calculator is one of the most complete and compact calculators available!

Your calculator answers problems in anything from basic math to trigonometry, statisitics and complex numbers. It can judge which arithmetic operation must be performed first and lets you use up to 18 parentheses at six levels.

The calculator saves you time by converting from one unit to another (fraction to decimals, minutes and seconds to degrees, degrees to radians or grads, hexadecimals to decimals, binaries or octals, even volts × amps to watts) whenever you tell it to. It also saves your battery by automatically turning itself off if you don't use it for 6 minutes.

Your calculator's seven memory registers hold information for later use — even after you turn it off.

We want your EC-4035 to become your problem-solving right hand! Following the examples in this manual is the first step toward that goal.

You don't have to read the entire manual if you're interested only in one operation or procedure. (After all, you don't read the entire cookbook to bake a cake or read every entry in the phone directory to find a number.) We suggest you begin by reviewing the Contents. When you identify an operation you want to perform, turn to that page. There you will find the procedure and other supporting information such as calculation accuracy or allowable input range.

By the way, we didn't intend to make this manual as a tutorial book for mathematics. We assume you need this calculator as an aid to solve the problem at hand. If you are not familiar with the functions built into your EC-4035 and want to know what its application is, your local library is the best source for the information.

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■ POWER

Slide the power switch up to turn on the calculator. Slide it down to turn it off. Even when power is off, the memory contents — both independent and constant — are retained.

Batteries

Your calculator is powered by two CR2032 lithium batteries (Cat. No. 23-162), which provide approximately 350 continuous hours of operation. Replace the batteries when the display becomes dim. We recommend that you replace batteries at least every two years even if you do not use the calculator. Old batteries tend to leak and can damage the calculator. Be sure you replace both batteries. Never mix old and new batteries.

1. Switch the power off.
2. Remove the back cover by loosening the two screws.
3. Remove the battery compartment cover screw and take out the old batteries.
4. Install two new batteries, positive (+) side up.
5. Dispose of the old batteries promptly. Do not incinerate them or allow children to play with them. They can prove fatal if swallowed.
6. Replace the battery compartment cover.
7. Replace the back cover.

8. Switch the power on and press the ᴿᴱˢᴱᵀ button on the lower back of the unit, using a ball-point pen or similar object.

Auto Power-Off

If you leave the calculator on, and do not press a key within six minutes, the calculator turns off automatically, thereby conserving the batteries. To restore power, press the **AC** key or slide the power switch to OFF and then back to ON.

■ DISPLAY

Mode display   Angular unit   Exponent

```
K M  Kin Kout UNIT  SD LR    CMPLX   D R G   - 99
S M  hyp Sym ENG DEC HEX BIN OCT  FIX SCI
   ← -1.234567890 →
```
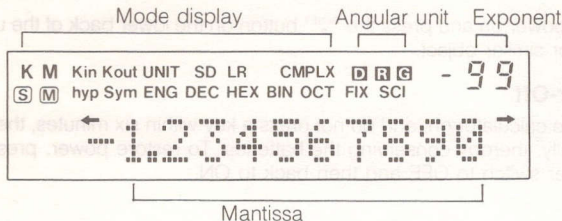
Mantissa

The display can show a mantissa of up to 10 digits and an exponent of up to 2 digits.

Note: Displays for special modes and angular units are explained with the related functions, later in the manual.

On the right side of the calculator is the DISP (display contrast) control. If the display is difficult to read, adjust this control for best contrast. If you cannot adjust the display to a high contrast, the batteries are weak. Replace them immediately.

■ SPECIAL KEYS

This section describes five special keys that affect the overall operation of the EC-4035.

SHIFT Key

To keep your calculator as compact as possible, each key has two or more functions. You can change the main function to the secondary function (printed in brown above the key) by pressing [SHIFT] first. Press [SHIFT], and an Ⓢ appears on the display. Then, press a function key. The function printed above the key is performed, and the Ⓢ disappears from the display. Press [SHIFT] a second time to cancel.

MODE Key

This key lets you change the operating characteristics of your calculator. There are five **calculation modes, three angular unit** modes, and four **display** modes. To place your calculator in one or more of these modes, press [MODE] followed by the appropriate key. An M appears on the display when you press [MODE].

⊡ Enters/exits the Engineering Display mode. (ENG appears/disappears on the display.)
  In this mode, calculation results are displayed using exponents of 10 that are multiples of 3. See "Engineering Mode," under "Scientific Notation."

[0] Enters the Unit Calculation mode. UNIT appears on the display, and calculations using seven types of units, such as watts, can be carried out. See "Unit Mode," under "Scientific Notation."

[1] Enters Normal Calculation mode. Pressing MODE [1] cancels the Unit, Base-n, Complex, Standard Deviation, or Linear Regression mode.

[2] Enters Base-n Calculation mode. Binary/octal/decimal/hexadecimal calculations or conversions and logical operations can be performed in base-2, 8, 10, or 16. See "Binary, Octal, Decimal, and Hexadecimal."

[3] Enters Complex Calculation mode. CMPLX appears on the display. See "Complex Numbers."

[4] Sets the angular mode, used for trigonometric calculations, to degrees. **D** appears on the display. See "Trigonometric functions," under "Function Calculations."

[5] Sets the angular mode to radians. **R** appears on the display.

[6] Sets the angular mode to grads. **G** appears on the display.

[7] Sets the display to show a specified number of decimal places. FIX is displayed. See "Setting Decimal Places," under "General Information."

[8] Sets the display to show the specified number of significant digits. SCI is displayed. See "Setting Significant Digits," under "General Information."

☐ Cancels the FIX or SCI setting.

➕ Enters Standard Deviation Calculation mode. SD is displayed. See "Means and Standard Deviations," under "Statistical Calculations."

➖ Enters Linear Regression mode. LR is displayed. See "Regression Analysis," under "Statistical Calculations."

Sign-Change Key

Press the ✚⁄₋ key to change the sign of the displayed value. Press it after pressing ⒺⓍⓅ to change the sign of the exponent.

Parentheses

If you want the EC-4035 to perform a calculation normally of a lower priority before performing another, place the lower-priority calculation in parentheses. You can have up to six levels of parentheses (parenthetic expressions within parenthetic expressions). The number of parentheses is displayed.

Pi Key

To enter the value pi (the ratio of circumference to the diameter of the circle), press ⒺⓍⓅ without entering any number. The value of pi (to 9 decimal places) is placed on the display.

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■ GENERAL INFORMATION

Priority of Calculations

Your EC-4035 observes true algebraic logic. This means that it performs calculations in the following order:

1. Parenthetic expressions, starting with the innermost parentheses and working to the outermost. For example, assume you enter:

   $(3+4) \times ((3+5)-5)$

   The calculator performs the calculations in the following order:

   $(3+4) \times ((3+5)-5)$
   $7 \times (8-5)$
   7×3

   The displayed result is 21.

2. Immediate functions (functions that immediately affect the value in the display), such as x^2, $x!$, sin, and cos.

3. Two-value functions, such as x^y, P→R, nPr, and so on. You must press ■ to complete the function.

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4. Multiplication, division

5. Addition, subtraction

6. AND

7. OR, XOR, XNOR

Operations of the same priority are performed in the order of input.

Correcting Mistakes

If you press the wrong number key, press $\blacksquare$, and enter the correct number. The previous calculations remain intact, and you can carry on the calculations. Or you can correct the last digit entered by pressing $\blacktriangleright$. The last digit on the display is erased, and the display shifts to the right one place.

If you press an incorrect immediate function key, you must re-enter your calculation.

For example, suppose you want to calculate the answer to $3 + 4 \times 5$, but you make a mistake:

3■4■■5■ 35 (wrong answer)
↑
error

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When you mistakenly enter ➖ instead of ✖, because the ➖ has same priority level as ➕, the calculator performs the addition first (7). Then, it waits for input of the value to be subtracted. The addition having already been done, the multiplier is applied to the result of addition ($7 \times 5 = 35$), instead of to the value 4 ($4 \times 5 + 3 = 23$).

If you want more information about the internal workings of the calculator and why they cause an incorrect result under such circumstances, see "Calculator Registers," at the back of the manual.

Setting Decimal Places (Using FIX)

Use the FIX function to specify the number of digits to be displayed after the decimal point. The calculator continues to calculate using the full 12 digits even though it displays only the number of digits you specify.

Press MODE 7 followed by the number of digits (0—9). FIX appears on the display, and displayed value is rounded to the number of digits you specify. To cancel this function, press MODE 9.

Example:	20 ➕ 7 ➖	2.857142857	
	MODE 7 2	2.86	(rounded off to two decimal places)
	MODE 9	2.857142857	(cancels the setting)

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Setting Significant Digits (Using SCI)

The SCI function is similar to FIX, but SCI specifies the total number of significant digits to display. The calculator continues to use up to 12 digits for calculating, even though the display shows only the number of digits you specify.

Press [MODE] [⊟] followed by the number of significant digits (0—9). SCI appears on the display, and the displayed value is rounded off to the number of significant digits you specify. To cancel, press [MODE] [⊟].

Example: 614 [⊟] .0056 [⊟]

109642.8571

[MODE] [⊟] [⊟]

1.10 05

(rounded off to 3 significant digits)

Rounding Off (Using RND)

As mentioned above, even though you specify the number of digits to display, the calculator continues to use 12 digits for the calculations. To set the number that the calculator to be exactly equal to the number in the display when using the FIX or SCI mode, press [SHIFT] [RND].

Example:

	20 `+` 7 `=`	2.857142857
	`MODE` `7` `2`	2.86
	`SHIFT` `RND`	2.86
	`SHIFT` `x²`	8.18

Compare with following

	20 `+` 7 `=`	2.857142857
	`MODE` `7` `2`	2.86
	`SHIFT` `x²`	8.16

Errors

When a calculation or the result of an operation exceeds the calculation range, an error code is displayed, and you must correct the error to continue.

Ma ERROR

This error is shown if one of the following conditions occurs. Press `AC` to clear the error. Then start the calculation again.

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- The result — intermediate or final — or the memory content exceeds the value $\pm 9.999999999 \times 10^{99}$.
- You input a number outside the input range for a function calculation. See each function description for the allowable input range.
- You attempt an improper operation.
- Trying to determine average or standard deviation without inputting data in Standard Deviation or Regression Calculation mode.
- Try a conversion the result of which overflows the display capacity in Base-n mode.
- Trying to obtain trigonometrics of an imaginary number in Complex Calculation mode.

Syn ERROR

You get a syntax error under the following circumstances. Press ⏺ and re-start the calculation from the beginning.

- In standard deviation or regression calculation, you pressed the ⌨DATA⌨, ⌨DEL⌨ or ⌨x₀,y₀⌨ key before completing the pending calculation (except ⏺ to enter multiple data).
- You pressed ⏺ for an imaginary number in the Complex Calculation mode.

( ) ERROR

This error occurs if the nesting level exceeds six or if you use more than 18 consecutive open parentheses. Press ⏺ to clear the error. The display returns to the value input immediately before the error, and you can continue calculation. Or press ⏺ and begin the calculation again.

1. FOUR BASIC CALCULATIONS (+ − × ÷)

Select the normal calculation (COMP mode) by pressing [MODE][1].
Calculations are performed in the same sequence as the written formula designates. And you can nest up to 18 parentheses at six levels.
The calculation range allows 10 digit mantissa plus a 2-digit exponent up to $10^{\pm 99}$.

EXAMPLE	OPERATION	READ-OUT
$23+4.5-53=-25.5$	23[+]4.5[−]53[=]	−25.5
$7\times8-4\times5\ (=56-20)=36$	7[×]8[−]4[×]5[=]	36.

Sign Change

Press [+/−] to change the sign of the displayed value. Press it after pressing [EXP] to change the sign of the exponent.

EXAMPLE	OPERATION	READ-OUT
$56\times(-12)\div(-2.5)=268.8$	56[×]12[+/−][÷]2.5[+/−][=]	268.8

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Constant

Press one of the four basic calculation keys ($+$, $-$, $\times$, $\div$) twice to store the displayed value as a constant. K appears on the display to indicate that a value is stored as a constant.

EXAMPLE	OPERATION	READ-OUT
$3+2.3=5.3$	2.3 ➕ ➕ 3 ➖	^K 5.3
$6+2.3=8.3$	6 ➖	^K 8.3
$7-5.6=1.4$	5.6 ➖ ➖ 7 ➖	^K 1.4
$-4.5-5.6=-10.1$	4.5 ⊬ ➖	^K −10.1
$2.3\times12=27.6$	12 ✖ ✖ 2.3 ➖	^K 27.6
$(-9)\times12=-108$	9 ⊬ ➖	^K −108.
$74\div2.5=29.6$	2.5 ➗ ➗ 74 ➖	^K 29.6
$85.2\div2.5=34.08$	85.2 ➖	^K 34.08

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$1.7^2 = 2.89$	1.7 ⊠ ⊠ ⊟	K	2.89
$1.7^3 = 4.913$	⊟	K	4.913
$1.7^4 = 8.3521$	⊟	K	8.3521

$3 \times 6 \times 4 = 72$	3 ⊠ 6 ⊠ ⊠	K	18.
$3 \times 6 \times (-5) = -90$	4 ⊟	K	72.
	5 ⊬ ⊟	K	-90.

$\dfrac{56}{4 \times (2+3)} = 2.8$	4 ⊠ ⟮⟮ 2 ⊞ 3 ⟯ ⊡ ⊡	K	20.
$\dfrac{23}{4 \times (2+3)} = 1.15$	56 ⊟	K	2.8
	23 ⊟	K	1.15

The constant is stored in the Y register. You can check the contents of the constant by using the x↔y key. See "Register Exchange."

Parentheses

When you want to perform a calculation of lower priority before one of higher priority, enclose the lower-priority calculation in parentheses. The number of parentheses is displayed.

EXAMPLE	OPERATION	READ-OUT	
$2 \times \{7 + 6 \times (5 + 4)\} = 122$	2 ▣ ⦅	(01	0.
	7 ➕ 6 ▣ ⦅	(02	0.
	5 ➕ 4 ⦆ ⦆ 🟰		122.

You can omit the closing parentheses if they come immediately before the 🟰 key.

EXAMPLE	OPERATION	READ-OUT
$10 - \{7 \times (3 + 6)\} = -53$	10 ➖ ⦅ 7 ▣ ⦅ 3 ➕ 6 🟰	−53.

Register Exchange (X↔Y)

[SHIFT] [X↔Y] exchanges the displayed number (X register) with the contents of the working register (Y register). (See "Calculator Registers" for more information about registers.) This means that you can reverse a division problem so that A ÷ B becomes B ÷ A. This feature is convenient if the denominator of a fraction contains multiplication or division. (The numerator must not contain any operations.)

EXAMPLE	OPERATION	READ-OUT
$\dfrac{7.4}{1.23\times4.56\div2}=$	1.23 [×] 4.56 [÷] 2 [=]	2.8044
	7.4 [SHIFT] [X↔Y] [=]	2.638710598
$\dfrac{10.5}{21\div7.8}=$	21 [÷] 7.8 [=]	2.692307692
	10.5 [SHIFT] [X↔Y] [=]	3.9

Fractions

You can enter fractions such as $3\frac{3}{4}$ as they are written instead of having to convert them to improper fractions. Enter the integer part, press [a⅘] , enter the numerator, press [a⅘] , and then enter the denominator.

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Note that the slash takes one digit on the display. This limits the range of a input fraction to a total of eight digits. If the calculation's result exceeds this limit, the answer is automatically shown in decimal.

If you want the answer displayed in decimal form, press the ab/c key after the answer is obtained. Pressing ab/c again converts the answer back into a fraction.

Note: You cannot convert a decimal answer to a fraction.

EXAMPLE	OPERATION	READ-OUT
$4\frac{5}{6} \times (3\frac{1}{4} + 1\frac{2}{3}) \div 7\frac{8}{9} = 3\frac{7}{568}$	4 ab/c 5 ab/c 6 ✕ ((3 ab/c 1 ab/c 4 ➕ 1 ab/c 2 ab/c 3)) ➗ 7 ab/c 8 ab/c 9 ➖	3/7/568.
(=3.012323944)	ab/c	3.012323944
$2\frac{4}{5} + \frac{3}{4} - 1\frac{1}{2} = 2\frac{1}{20}$	2 ab/c 4 ab/c 5 ➕ 3 ab/c 4 ➖	3/11/20.
	ab/c	3.55
	1 ab/c 1 ab/c 2 ➖	2/1/20.

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$(1.5 \times 10^7) - \{(2.5 \times 10^6) \times \dfrac{3}{100}\}$

$=14925000$ 1.5 [EXP] 7 [−] 2.5 [EXP] 6 [×] 3 [a%] 100 [=] | 14925000. |

When you enter an operator or press [=] , the entered fraction is automatically converted to a proper fraction reduced to its lowest common denominator.

EXAMPLE	OPERATION	READ-OUT
$3\dfrac{456}{78}=8\dfrac{11}{13}$ (Reduction)	3 [a%] 456 [a%] 78	3/456/78.
	[=]	8/11/13.

Or you can make it an improper fraction by pressing [SHIFT] [d/c].

Countinuing from above   [SHIFT] [d/c] | 115/13. |

If any operand is decimal, the answer is shown in decimal form.

| $\dfrac{41}{52} \times 78.9 = 62.20961538$ | 41 [a%] 52 [×] | 41/52. |
| | 78.9 [=] | 62.20961538 |

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Percentage

To find the percentage of a number, enter the number first, then press ☒ , the percent, and SHIFT %. For the percent increase on the answer (markup), press ☐ after SHIFT %. For the percent reduction (discount), press ☐ .

EXAMPLE	OPERATION	READ-OUT
What is 12 % of 1500 180	1500 ☒ 12 SHIFT %	180.
What percent of 880 is 660? 75%	660 ☐ 880 SHIFT %	75.
Increase 2500 by 15% 2875	2500 ☒ 15 SHIFT % ☐	2875.
Decrease 3500 by 25% 2625	3500 ☒ 25 SHIFT % ☐	2625.

EXAMPLE	OPERATION	READ-OUT
300cc are added to a 500cc solution. What is the percent of the new volume to the old volume?	300 **+** 500 [SHIFT] [%]	160. (%)
If you made $80 last week and $100 this week, what is the percent increase?	100 **−** 80 [SHIFT] [%]	25. (%)

Use constants to calculate:

12% of 1200 144	1200 **×** **×** 12 [SHIFT] [%]	ᴷ 144.
18% of 1200 216	18 [SHIFT] [%]	ᴷ 216.
23% of 1200 276	23 [SHIFT] [%]	ᴷ 276.

26% of 2200 572	26 **×** **×** 2200 [SHIFT] [%]	ᴷ 572.
26% of 3300 858	3300 [SHIFT] [%]	ᴷ 858.
26% of 3800 988	3800 [SHIFT] [%]	ᴷ 988.

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What percent of 192 is 30?	192 [÷] [÷] 30 [SHIFT] [%]
What percent of 192 is 156?	
	156 [SHIFT] [%]

^{K}	15.625
^{K}	81.25

600g is added to 1200g. What percent is the total weight to the initial weight?	1200 [+] [+] 600 [SHIFT] [%]
510g is added to 1200g. What percent is the total weight to the inital weight?	510 [SHIFT] [%]

^{K}	150.
^{K}	142.5

How many percent less is 138g than 150g?	150 [−] [−] 138 [SHIFT] [%]
How many percent less is 129g than 150g?	129 [SHIFT] [%]

^{K}	−8.
^{K}	−14.

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2. MEMORY CALCULATIONS

Standard Memory

Standard memory is the independent memory available on most calculators. The calculation range allows a 10-digit mantissa and a 2-digit exponent up to $10^{\pm 99}$.
The memory keys function as follows:

[Min] (memory in) ..... stores the displayed value into memory, clearing the previous contents.

[M+] (memory add) ..... adds the displayed value or the result of a pending calculation to the value in memory.

[SHIFT] [M–] (memory subtract) ... subtracts the displayed value or the result of a pending calculation from the value in memory.

[MR] (memory recall) ..... recalls the contents of memory to the display.

[X↔M] (memory exchange) ..... exchanges the displayed value (X register) and the contents of memory (memory register).

When a value is stored in memory, M appears on the display. The contents are preserved even after power is switched off. To clear the memory contents, press [AC] [Min].

EXAMPLE	OPERATION	READ-OUT

EXAMPLE	OPERATION	READ-OUT
53+6= 59	53 ➕ 6 ➖ Min	**M** 59.
23−8= 15	23 ➖ 8 M+	**M** 15.
56×2=112	56 ✖ 2 M+	**M** 112.
+) 99÷4= 24.75	99 ➗ 4 M+	**M** 24.75
210.75	MR	**M** 210.75

7+7−7+(2×3)+(2×3)+(2×3)−(2×3)=19

7 Min M+ M− SHIFT M− 2 ✖ 3 M+ M+ M+ SHIFT M− MR

M 19.

12×3= 36	3 ✖ ✖ 12 ➖ Min	**K M** 36.
−) 45×3=135	45 SHIFT M−	**K M** 135.
78×3=234	78 M+	**K M** 234.
135	MR	**K M** 135.

Constant Memories

There are six constant memories. Use them to store numbers you use often in your calculations.

[K in] (constant in) ..... Kin appears on the display. Press a number key 1—6 to select the constant memory to use. The calculator stores the displayed value into that memory 1 to 6, clearing the previous contents.

[K out] (constant out) ..... Kout appears on the display. Press a number key 1—6 to select the constant memory to recall. The number stored into that memory is recalled to the display.

[SHIFT] [KAC] ..... clears all constant memories.

To clear only one constant memory, press [AC], [K in], and then the number of the memory you wish to clear (1—6). The contents of constant memories are preserved even after you turn off the calculator.

EXAMPLE	OPERATION	READ-OUT
193.2÷23=8.4	193.2 [K in] ① ÷ 23 =	8.4
193.2÷28=6.9	[K out] ① ÷ 28 =	6.9
193.2÷42=4.6	[K out] ① ÷ 42 =	4.6

You can perform arithmetic calculations on the contents of the constant memories. Press the appropriate operator key before pressing the memory location number. That is, press [Kin] [+] [1] to add the displayed value to Constant Memory 1. The displayed value is not affected.

EXAMPLE	OPERATION	READ-OUT
	7 [Kin] [1] [×] 8 [Kin] [2] [×] 9 [Kin] [3] [=] [Min]	^M 504.
	4 [Kin] [+] [1] [×] 5 [Kin] [+] [2] [×] 6 [Kin] [+] [3] [M+]	^M 120.
	3 [Kin] [+] [1] [×] 6 [Kin] [+] [2] [×] 9 [Kin] [+] [3] [M+]	^M 162.
$7 \times 8 \times 9 = 504$	[Kout] [1]	^M 14.
$4 \times 5 \times 6 = 120$	[Kout] [2]	^M 19.
$3 \times 6 \times 9 = 162$	[Kout] [3]	^M 24.
(Total) 14 19 24 786	[MR]	^M 786.

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3. SCIENTIFIC NOTATION

Calculation Range and Scientific Notation

-9.999999999 -10^9 -1 -10^{-2} -10^{-99} 0 10^{-99} 10^{-2} 1 10^9 9.999999999
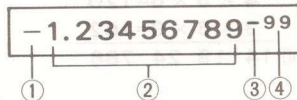$\times 10^{99}$ $\times 10^{99}$

Normal display   Scientific notation
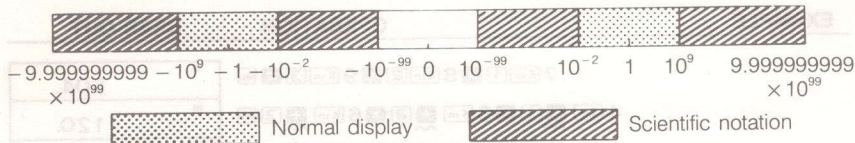
If the result of a calculation exceeds the normal display capacity, the result is automatically displayed using scientific notation, an 8-digit mantissa, and exponents of 10 up to ±99.

① The minus (−) sign for mantissa
② The mantissa
③ The minus (−) sign for exponent
④ The exponent of ten

The whole display is read: $-1.23456789 \times 10^{-99}$

To enter a value using scientific notation, enter the mantissa, press [EXP], and then enter the exponent.

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EXAMPLE	OPERATION	READ-OUT
$-1.23456789 \times 10^{-3}$	1.23456789 [+/-]	-1.23456789
$(=-0.00123456789)$	[EXP]	-1.23456789 00
	3 [+/-]	-1.23456789 -03

Engineering Mode

To change the displayed number so that it is shown with exponents of 10 that are multiples of 3, use the [ENG] or [ENG] key. [ENG] converts the displayed number to smaller units and [ENG] converts to larger units.

Example	12.3456	12.3456
	1st press [ENG]	12.3456 00
	2nd press [ENG]	12345.6 -03
	Next [ENG]	12345600. -06
	Next [ENG]	12345600. -06 (No change)

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	12.3456	12.3456
1st press ENG		0.0123456^{03}
2nd press ENG		0.0000123456^{06}
Next ENG		0.00000001234^{09}
Next ENG		0.000000012^{09} (No change)
ENG		0.0000123456^{06}
ENG		0.0123456^{03}

You can also use the Engineering mode. In this mode, the unit symbol appears instead of the exponent of 10.

To select the Engineering mode, press MODE ·. ENG appears on the display. To exit the Engineering Mode, press MODE · again. ENG disappears from the display.

Unit	Unit symbol	Unit	Unit symbol
10^3	k (Kilo)	10^{-3}	m (Milli)
10^6	M (Mega)	10^{-6}	μ (Micro)
10^9	G (Giga)	10^{-9}	n (Nano)
10^{12}	T (Tera)	10^{-12}	p (Pico)
10^{15}	P (Peta)	10^{-15}	f (Femto)
10^{18}	E (Exa)	10^{-18}	a (Atto)

In this mode, normal calculation results can also be shown with a unit symbol.

To enter a value using the unit symbol, use the [Sym] key, followed by the unit symbol key (printed in black under the function keys).

EXAMPLE	**OPERATION**	**READ-OUT**
$100m\,(milli) \times 5\mu\,(micro) = 500n\,(nano)$	[MODE] [·] 100 [Sym] [ENG/m] [×] 5 [Sym] [ENG/μ] [=]	500.n

$9 \div 10 = 0.9 = 900m\,(milli)$ 9 ⊞ 10 ⊟ | 900. m

(Continuing) [ENG] | 0.9

(Continuing) [ENG] | 900. m

If you press a symbol without specifying a value, a value of 1 is automatically entered.

$1K\,(kilo) \times 1K\,(kilo) = 1M\,(mega)$ [Sym] [ab/c K] ☒ ⊟ | 1. M

When the result is outside the range of the symbol display, the calculator uses exponential display.

$1E\,(exa) \times 1000 = 10^{21}$ [Sym] [tan E] ☒ 1000 ⊟ | $1.^{21}$

Note: You cannot use unit symbols for fractions.

Unit Mode

In this mode you can perform calculations in terms of 7 units common to the field of electrical engineering (watts, ohms, and so on).

To select the Unit mode press [MODE][0]. UNIT appears on the display.

To exit Unit mode select any other mode (except ENG).

To enter a unit, press [Sym], followed by the unit's symbol (0—6). The symbols are printed in black below the keys.

Name	Symbol	Definition	
Electrical potential, volts	V		
Electrical conductivity, amperes	A		
Time, seconds	S		
Power, watts	W	$1W = 1V \cdot A$	
Electrical capacitance, farads	F	$1F = 1A \cdot S \cdot V^{-1}$	Derived units
Quantity of electricity, coulombs	C	$1C = 1A \cdot S$	
Electrical resistance, Ohms	Ω	$1\Omega = 1V \cdot A^{-1}$	

Calculations involving the derived units are performed in the following order:

1. W (watts)
2. F (farads)
3. C (coulombs)
4. Ω (ohms)
5. V, A, S (volts, amps, seconds)

The unit can be raised to ±5th power. (The power must be an integer.) If the calculation's result exceeds this limit, or if the power becomes a fraction, the subsequent calculation is carried out without the unit symbols.

You cannot store the unit symbol in memory. Only the numeric values are stored.

You can use the unit symbols in combination with the engineering symbols.

EXAMPLE	OPERATION	READ-OUT
	[MODE] [O]	
5A (amperes) + 6A (amperes) = 11A (amperes)	5 [Sym] [①/A] [+] 6 [Sym] [①/A] [=]	11. A
12V (volts) × 5A (amperes) = 60W (watt)	12 [Sym] [♡/V] [×] 5 [Sym] [①/A] [=]	60. W

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3F (farads) × 4V (volts) = 12C (coulombs) 3 [Sym] [F] [×] 4 [Sym] [V] [=]   **12. C**

$(6S)^2 = 36S^2$ 6 [Sym] [S] [SHIFT] [x^2]   **36. S ^{2}**

[MODE] [·] (ENG mode)

300mA (milliamperes) 300 [Sym] [m] [ENG] [A]
× 900mV (millivolts) =
= 270mW (milliwatts) [×] 900 [Sym] [m] [ENG] [Sym] [V] [=]   **270.mW**

4. BINARY, OCTAL, DECIMAL AND HEXADECIMAL

You can perform binary, octal, decimal and hexadecimal calculations and conversions by placing the EC-4035 in the Base-*n* mode.

To select the Base-*n* mode, press MODE 2. DEC, HEX, BIN, or OCT appears on the display.

To exit the Base-*n* mode, select an mode other than ENG.

To select the base, press the DEC , HEX , BIN or OCT key on the top row of the keyboard.

Calculation range:

BASE	DIGITS	RANGE
Binary	12	Positive : $0 \leq x \leq 11111111111$
		Negative: $100000000000 \leq x \leq 111111111111$
Octal	11	Positive : $0 \leq x \leq 17777777777$
		Negative: $20000000000 \leq x \leq 37777777777$
Decimal	10	Positive : $0 \leq x \leq 2147483647$
		Negative: $-2147483648 \leq x \leq -1$
Hexadecimal	8	Positive : $0 \leq x \leq 7FFFFFFF$
		Negative: $80000000 \leq x \leq FFFFFFFF$

Valid values:

BASE	VALUES
Binary	0, 1
Octal	0, 1, 2, 3, 4, 5, 6, 7
Decimal	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Hecadecimal	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

*Values other than noted above cannot be entered while each respective base is in effect.

The keys used in this mode have their function names printed in green below them. As you might have noticed, the advanced function keys do not operate in this mode (even if you set the base as decimal). Memory and parentheses calculations can be performed, as well as the four basic calculations.

You cannot enter decimal fractions in this mode. If the calculation's result causes a fraction, the calculator automatically rounds the fraction to an integer.

Conversion

EXAMPLE	OPERATION	READ-OUT

$\boxed{\text{MODE}}$ $\boxed{2}$ (BASE-n mode)

Conversion of 22_{10} to binary $\boxed{\text{DEC}}$ **22** $\boxed{\text{BIN}}$

	10110.

to octal $\boxed{\text{OCT}}$

26.

to hexadecimal $\boxed{\text{HEX}}$

16.

Conversion of 2050_{10} to binary $\boxed{\text{DEC}}$ **2050** $\boxed{\text{BIN}}$

Ma ERROR

*Conversion may sometimes be impossible if calculation range of original value is greater than range of result value.

Conversion of $7FFFFFFF_{16}$ to decimal $\boxed{\text{HEX}}$ **7FFFFFFF** $\boxed{\text{DEC}}$

2147483647.

Conversion of 34000000000_8 to decimal $\boxed{\text{OCT}}$ **34000000000** $\boxed{\text{DEC}}$

−536870912.

Conversion of 123456_{10} to octal   [DEC] 123456 [OCT]   `361100.`

Conversion of 1100110_2 to decimal   [BIN] 1100110 [DEC]   `102.`

Calculation

EXAMPLE	OPERATION	READ-OUT
	[MODE] [2] (BASE-n mode)	
$10111_2 + 11010_2 = 1100001_2$	[BIN] 10111 [+] 11010 [=]	`110001.`
$123_8 \times ABC_{16} = 37AF4_{16}$	[OCT] 123 [×] [HEX] ABC [=]	`37AF4.`
$\quad = 228084_{10}$	[DEC]	`228084.`
$1F2D_{16} - 100_{10} = 7881_{10}$	[HEX] 1F2D [−] [DEC] 100 [=]	`7881.`
$\quad = 1EC9_{16}$	[HEX]	`1EC9.`

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$7654_8 \div 12_{10} = 334.3\cdots\cdots_{10}$ [OCT] 7654 [÷] [DEC] 12 [=]

	334.

$= 516_8$ [OCT]

	516.

*Fractional parts of calculation results are truncated.

$110_2 + 456_8 \times 78_{10} \div 1A_{16} = 390_{16}$ [BIN] 110 [+] [OCT] 456 [×] [DEC] 78 [÷] [HEX] 1A [=]

	390.

$= 912_{10}$ [DEC]

	912.

$BC_{16} \times (14_{10} + 69_{10}) = 15604_{10}$ [HEX] BC [×] [(] [DEC] 14 [+] 69 [)] [=]

	15604.

$= 3CF4_{16}$ [HEX]

	3CF4.

$\underline{23_8} + 963_{10} = 982_{10}$ [OCT] 23 [Min] [+] [DEC] 963 [=]

	982.

$\underline{23_8} + 101011_2 = 111110_2$ [MR] [+] [BIN] 101011 [=]

	111110.

$2A56_{16} \times \underline{23_8} = 32462_{16}$ [HEX] 2A56 [×] [MR] [=]

	32462.

$2B_{16} \times CD_{16} = 226F_{16}$	HEX 2B ✕ CD =	226F.
$2B_{16} \times 58_{10} = 2494_{10}$	DEC 58 =	2494.
$2B_{16} \times 63_8 = 4221_8$	OCT 63 =	4221.

Negatives

To obtain a negative value, press NEG . The two's complement of the value on the display is produced for binary, octal, and hexadecimal numbers.

EXAMPLE	OPERATION	READ-OUT
	MODE 2 (BASE-n mode)	
Negation of 1010_2	BIN 1010 NEG	111111110110.
Conversion to decimal	DEC	−10.
Negation of 1_2	BIN 1 NEG	111111111111.
Negation of 2_8	OCT 2 NEG	37777777776.
Negation of 34_{16}	HEX 34 NEG	FFFFFFCC.

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Logical Operations

Use the AND , OR , XOR , XNOR , and NOT keys to perform logical operations.

EXAMPLE	OPERATION	READ-OUT
	MODE 2 (BASE-n mode)	
19_{16} AND $A_{16} = 18_{16}$	HEX 19 AND 1A =	18.
1110_2 AND $36_8 = 1110_2$	BIN 1110 AND OCT 36 =	16.
	BIN	1110.
23_8 OR $61_8 = 63_8$	OCT 23 OR 61 =	63.
120_{16} OR $11011_2 = 12D_{16}$	HEX 120 OR BIN 1101 =	100101101.
	HEX	12D.
5_{16} XOR $3_{16} = 6_{16}$	HEX 5 XOR 3 =	6.
$2A_{16}$ XNOR $5D_{16} = FFFFFF88_{16}$	HEX 2A XNOR 5D =	FFFFFF88.
1010_2 AND (A_{16} OR 7_{16})	BIN 1010 AND ((HEX A OR 7)) =	A.
$= 1010_2$	BIN	1010.

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$1A_{16}$ AND $2F_{16}$ [HEX] 2F [AND] [AND] 1A [=]   **A.**

$3B_{16}$ AND $2F_{16}$ 3B [=]   **2B.**

Not of 10110_{10} [BIN] 10110 [NOT]   `111111101001.`

Not of 1234_{8} [OCT] 1234 [NOT]   `37777776543.`

Not of $2FFFED_{16}$ [HEX] 2FFFED [NOT]   `FFD00012.`

5. DIGITAL NOTATION AND DEGREE-MINUTE-SECOND NOTATION

The EC-4035 allows you to enter angle and times measurements in the units you usually use to measure them (degrees/hours, minutes, and seconds). It uses a decimal system to perform the calculations. Then, it displays the result in digital notation, which you can have it convert to DMS (degree-minute-second) notation.

Use the 👁 and [SHIFT] 👁 keys. To enter a value using DMS notation, enter the degree (or hour), press 👁 , enter the minute, press 👁 , and enter the second and press 👁 . As you enter the value, the calculator automatically converts to digital notation.

To change the value on display to DMS notation, press [SHIFT] 👁 .

EXAMPLE	OPERATION	READ-OUT
14°25′36″ = 14.42666667°	14 👁	14.
	25 👁	14.41666667
	36 👁	14.42666667
	[SHIFT] 👁	14°25′36.″

6. ANGULAR MODES

You must set the angular mode you wish to use for trigonometric functions, polar/rectangular coordinate conversions, and when obtaining the argument of the complex number.

Setting the angular mode:
Press MODE ④ if you are using degrees.
Press MODE ⑤ for radians.
Press MODE ⑥ for grads.

D, R or G appears on the display to tell you which mode you are now in.

Conversions

You can convert a displayed value from one angular unit to another:
Press SHIFT MODE ④ to convert to degrees.
Press SHIFT MODE ⑤ to convert to radians.
Press SHIFT MODE ⑥ to convert to grads.

Note: To enter the value of pi for calculation in radians, press EXP before entering any number.

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7. COMPLEX NUMBERS

To select the Complex Number mode, press MODE ③ . CMPLX appears on the display.

To exit the Complex Number mode, select any other mode (except ENG).

Calculation Range:

* Addition/subtraction

$|A \pm C| < 10^{100}$

$|B \pm D| < 10^{100}$

* Multiplication

$|AC| < 10^{100}$

$|BD| < 10^{100}$

$|AC - BD| < 10^{100}$

$|BC| < 10^{100}$

$|AD| < 10^{100}$

$|BC + AD| < 10^{100}$

* Division

$|AC| < 10^{100}$

$|BD| < 10^{100}$

$|AC + BD| < 10^{100}$

$|BC| < 10^{100}$

$|AD| < 10^{100}$

$|BC - AD| < 10^{100}$

Calculation Limits: Nesting of up to 12 levels, parentheses of up to 4 levels.

The keys that have a special function in this mode have purple lettering above them.

Press ⓘ after entering the imaginary part of the number.

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EXAMPLE	OPERATION	READ-OUT
$1.23+4.56i=$	[MODE] [3] (CMPLX mode)	
$1.23+4.56i$	1.23 [+]	1.23
	4.56 [i]	4.56 i
	[=]	1.23+4.56 i

The pending value or the result of the calculation is displayed as far left as possible.

$1.2\times10^{14}+3.4i=$	1.2 [EXP] 14	1.2^{14}
$1.2\times10^{14}+3.4i$	[+]	1.2E14
	3.4 [i] [=]	1.2E14+3.4 i

Displayed exponents are preceded by an E.

You can use fractions, unit symbols, and advanced functions in this mode. If you attempt to use a trigonometric function when the current value includes an imaginary portion, Ma ERROR is displayed.

$\frac{2}{5}i = \frac{2}{5}i$	2 [a%] 5 [i] [=]	2/5. i
$5K\,i = 5K\,i$	[MODE] [.] 5 [SHIFT] [Sym] [a%/K] [i] [=]	5. k i

Calculations

The priority of calculations is the same as in real number-only calculations.

EXAMPLE	OPERATION	READ-OUT
$12i - 34i = -22i$	12 [i] [-] 34 [i] [=]	-22. i
$8 \times 2i - 18 \div 3i = 22i$	8 [×] 2 [i] [-] 18 [÷] 3 [i] [=]	22. i

If the result of a calculation becomes too long to be shown on the display, an arrow appears on the display. Press [◄] to shift the display left so that you can see the rest of the result. Press [SHIFT] [►] to shift it to the right.

$(1.23 + 4.56i) \div 80 =$	[(] 1.23 [+] 4.56 [i] [)] [÷] 80 [=]	0.015375+0.057*
$0.015375 + 0.057i$	[shift arrows]	*0.15375+0.057 i

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Arguments, Absolute Values

Use the [arg] key to obtain the argument (or amplitude) of a complex number. Verify or change the angular mode before pressing [arg]. Press [|z|] to obtain the absolute value (modulus).

If you are going to find both the argument and absolute value of the complex number, first store the value into memory by pressing [Min]. Now press [arg] to determine the argument. Press [MR] to recall the complex number to the display, and press [|z|] to find the absolute value. When you press either the [arg] or [|z|] key, the original complex number is cleared from the display.

EXAMPLE	OPERATION	READ-OUT
	[MODE][3] (CMPLX mode)	
How many degrees is the argument of $5 + 8i$?	[MODE][4] (DEG) 5+8[i][=][arg]	57.99461679
How many radians is the argument of $3.2 - 4.8i$?	[MODE][5] (RAD) 3.2[-]4.8[i][=][arg]	-0.9827937233
What is the absolute value of $7 + 4i$?	7[+]4[i][=][|z|]	8.062257748

Note: You cannot convert the polar coordinate value to a complex number on this calculator. (In other words, you cannot obtain the complex number by giving an argument and absolute value.)

Conjugate Numbers

Press [conjg] to obtain the conjugate number of the complex number.

EXAMPLE	OPERATION	READ-OUT
What is the conjugate complex number of $8 + 5i$?	8 ➕ 5 [i] [=] [conjg]	8.−5. i
What is the conjugate complex number of $3 \times (4 - 6i)$?	3 [×] [((] 4 ➖ 6 [i] [))] [=] [conjg]	12.+18. i

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8. FUNCTION CALCULATIONS

Function calculations are performed only in the COMP mode (MODE 1) unless otherwise noted. Some functions require time for calculation. Do not press any key while a calculation is in progress. (The display goes blank during calculations.)

Trigonometric Functions

Calculation Range and Accuracy

$\sin x/\cos x/\tan x$	$\lvert x \rvert < 9 \times 10^9$ deg	$\left(\begin{array}{l} 5 \times 10^7 \pi \text{ rad} \\ 1 \times 10^{10} \text{ gra} \end{array} \right)$	± 1 in the 10th digit
$\sin^{-1}x/\cos^{-1}x$	$\lvert x \rvert \leqq 1$		— " —
$\tan^{-1}x$	$\lvert x \rvert < 10^{100}$		— " —

EXAMPLE	OPERATION	READ-OUT
$\sin\left(\dfrac{\pi}{6} \text{ rad}\right) = 0.5$	"RAD" (MODE 5) π ÷ 6 = sin	0.5
$\cos 63°52'41'' =$	"DEG" (MODE 4) 63 °'" 52 °'" 41 °'"	63.87805556
0.4402830847	cos	0.4402830847

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$\tan(-35\text{gra}) =$
$\quad -0.6128007881$ "GRA" ([MODE] [6]) 35 [+/-] [tan]   `-0.6128007881`

$2 \cdot \sin 45° \times \cos 65°$
$= 0.597672477$ "DEG" 2 [×] 45 [sin] [×] 65 [cos] [=]   `0.597672477`

$\sin^{-1} \frac{1}{2} = 30°$ "DEG" 2 [SHIFT] [1/x] [SHIFT] [sin]   `30.`

$\quad = 0.5235987756$ rad.   "RAD"   [SHIFT] [MODE] [5]   `0.5235987756.`

$\quad = 33.33333333$ grad.   "GRA"   [SHIFT] [MODE] [6]   `33.33333333`

After [SHIFT] [MODE], specifying [4] through [6] converts the currently displayed value to the corresponding angular unit.

$\cos^{-1} \frac{\sqrt{2}}{2} = 0.785398163$ rad   "RAD" 2 [√] [÷] 2 [=] [SHIFT] [cos]   `0.7853981634`

$\tan^{-1} 0.6104 = 31.39989118°$ "DEG" .6104 [SHIFT] [tan]   `31.39989118`

$\quad = 31° 23' 59.61''$ [SHIFT] [°'"]   `31° 23' 59.61"`

$\sin^{-1}0.8 - \cos^{-1}0.9$	"DEG"	.8 [SHIFT] [sin] [−] .9 [SHIFT] [cos] [=]
$= 27°17'17.41''$		[SHIFT] [°''']

	27.28816959
	27°17'17.41''

Hyperbolic Functions

Calculation Range and Accuracy

$\sinh x / \cosh x$	$\lvert x \rvert \leqq 230.2585092$	± 1 in the 10th digit
$\tanh x$	$\lvert x \rvert < 10^{100}$	— '' —
$\sinh^{-1} x$	$\lvert x \rvert < 5 \times 10^{99}$	— '' —
$\cosh^{-1} x$	$1 \leqq x < 5 \times 10^{99}$	— '' —
$\tanh^{-1} x$	$\lvert x \rvert < 1$	— '' —

hyp appears on the display when you press [hyp].

EXAMPLE	OPERATION	READ-OUT
$\sinh 3.6 = 18.28545536$	3.6 [hyp] [sin]	18.28545536
$\tanh 2.5 = 0.9866142981$	2.5 [hyp] [tan]	0.9866142981

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$\cosh 1.5 - \sinh 1.5 = 0.2231301602$
$$= e^{-1.5}$$

1.5 [Min] [hyp] [cos] [=]   M 2.352409615

[MR] [hyp] [sin] [=]   M 0.2231301602

[ln]   M −1.5

$\sinh^{-1} 30 = 4.094622224$

30 [SHIFT] [hyp] [sin]   4.094622224

$\cosh^{-1}\left(\dfrac{20}{15}\right) = 0.7953654612$

20 [÷] 15 [=] [SHIFT] [hyp] [cos]   0.7953654612

Solve $\tanh 4x = 0.88$

$$x = \frac{\tanh^{-1} 0.88}{4} =$$
$$0.3439419141$$

.88 [SHIFT] [hyp] [tan] [÷] 4 [=]   0.3439419141

$\sinh^{-1} 2 \times \cosh^{-1} 1.5 = 1.389388923$

2 [SHIFT] [hyp] [sin] [×]

1.5 [SHIFT] [hyp] [cos] [=]   1.389388923

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Logarithms / Exponentiations

Calculation Range and Accuracy

$\log x / \ln x$	$10^{-99} \leq x \leq 10^{100}$	± 1 in the 10th digit
e^x	$-10^{100} < x \leq 230.2585092$	— ,, —
10^x	$-10^{100} < x < 100$	— ,, —

EXAMPLE	OPERATION	READ-OUT
$\log 1.23 \ (=\log_{10} 1.23) = 0.08990511144$	1.23 [log]	0.08990511144
$\ln 90 \ (=\log_e 90) = 4.49980967$	90 [ln]	4.49980967
$\log 456 \div \ln 456 = 0.4342944819$	456 [Min] [log] [÷] [MR] [ln] [=]	$\overset{\text{M}}{0.4342944819}$
$10^{1.23} = 16.98243652$	1.23 [SHIFT] [10^x]	16.98243652
$e^{4.5} = 90.0171313$	4.5 [SHIFT] [e^x]	90.0171313

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$10^{0.4}+5 \cdot e^{-3}=2.760821773$

.4 [SHIFT] [10²] [+] 5 [×] 3 [+/−] [SHIFT] [eˣ] [=]	2.760821773

Squares/Square Roots/Cube Roots

Calculation Range and Accuracy

$\sqrt{x}$	$0 \leq x < 10^{100}$	± 1 in the 10th digit
$\sqrt[3]{x}$	$|x| < 10^{100}$	$- \, '' \, -$
x^2	$|x| < 10^{50}$	$- \, '' \, -$

EXAMPLE	OPERATION	READ-OUT
$\sqrt{2}+\sqrt{3}\times\sqrt{5}=5.287196909$	2 [√] [+] 3 [√] [×] 5 [√] [=]	5.287196909
$123+30^2=1023$	123 [+] 30 [SHIFT] [x²] [=]	1023.
$\sqrt[3]{5}+\sqrt[3]{-27}=-1.290024053$	5 [SHIFT] [∛] [+] 27 [+/−] [SHIFT] [∛] [=]	−1.290024053

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Powers / Roots

Calculation Range and Accuracy

x^y

$$\begin{cases} x > 0 \rightarrow -1 \times 10^{100} < y \cdot \log x < 100 & \pm 1 \text{ in the 10th digit} \\ x = 0 \rightarrow y > 0 & - \ '' \ - \\ x < 0 \rightarrow y : \text{integer or } \pm \ 1/2n + 1 (n : \text{integer}) & - \ '' \ - \end{cases}$$

$x^{1/y} \ (\sqrt[x]{x})$

$$\begin{cases} x > 0 \rightarrow y \neq 0, \ -10^{100} < 1/y \cdot \log x < 100 & - \ '' \ - \\ x = 0 \rightarrow y > 0 & - \ '' \ - \\ x < 0 \rightarrow y : \text{odd number or } \pm 1/n & - \ '' \ - \\ \qquad\qquad (n : \text{Integer}) \end{cases}$$

EXAMPLE	OPERATION	READ-OUT
$5.6^{2.3} = 52.58143837$	5.6 ⊠ 2.3 ▤	52.58143837
$123^{\frac{1}{7}} \ (= \sqrt[7]{123}) = 1.988647795$	123 [SHIFT] ⊠ 7 ▤	1.988647795

$(78-23)^{-12}$
$=1.305111829 \times 10^{-21}$

⟦⟧ 78 ➖ 23 ⟧ $\boxed{x^y}$ 12 $\boxed{\%}$ ➗ → $\boxed{1.305111829^{-21}}$

*x^y and $x^{1/y}$, can be registered as a constant.

$4^{2.5}=32$

2.5 $\boxed{x^y}$ $\boxed{x^y}$ 4 ➗ → $\boxed{^K \quad 32.}$

$0.16^{2.5}=0.01024$

.16 ➗ → $\boxed{^K \quad 0.01024}$

$9^{2.5}=243$

9 ➗ → $\boxed{^K \quad 243.}$

Reciprocals

Calculation Range and Accuracy

$1/x \qquad |x| < 10^{100}, x \neq 0$ $\qquad\qquad$ ±1 in the 10th digit

EXAMPLE	OPERATION	READ-OUT
$\dfrac{1}{\dfrac{1}{3}-\dfrac{1}{4}}=12$	3 SHIFT $\boxed{1/x}$ ➖ 4 SHIFT $\boxed{1/x}$ ➗ SHIFT $\boxed{1/x}$	12.

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Factorials

Calculation Range and Accuracy

$x!$	$0 \leq x \leq 69$ (x: integer)	± 1 in the 10th digit

EXAMPLE	OPERATION	READ-OUT
$8! (=1 \times 2 \times 3 \times \cdots\cdots \times 7 \times 8) = 40320$	8 [SHIFT] [$x!$]	40320.

Random Numbers

Generates a random number in the range 0.000 to 0.999.

[SHIFT] [RAN#]   0.570

(Example)
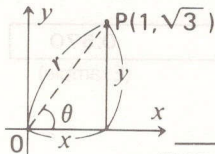
Rectangular/Polar Coordinates

Calculation Range and Accuracy

POL→REC	$|\theta| < 9 \times 10^9$ deg ($5 \times 10^7 \pi$ rad, 10^{10} gra)	± 1 in the 10th digit
	$|r| < 10^{100}$	
REC→POL	$\sqrt{x^2 + y^2} < 10^{100}$	— '' —

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Formula: $r = \sqrt{x^2 + y^2}$

$$\theta = \tan^{-1} \frac{y}{x} \quad (-180° < \theta \leq 180°)$$

Ex.)

Find the length r and angle θ in radian when the point P is shown as $x = 1$ and $y = \sqrt{3}$ in the rectangular co-ordinates.

	OPERATION	READ-OUT	
"RAD" ([MODE] [5])	1 [SHIFT] [R→P] 3 [√] [=]	2.	(r)
	[SHIFT] [X↔Y]	1.047197551	$(\theta$ in radian)

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Formula: $x = r \cdot \cos\theta$
$y = r \cdot \sin\theta$

Ex.)

Obtain the values of x and y when the point P is shown as $\theta = 60°$ and length $r = 2$ in the polar co-ordinates.
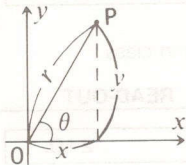
	OPERATION	READ-OUT	
	"DEG" (MODE 4) 2 SHIFT P→R 60 =	1.	(x)
	SHIFT x→y	1.732050808	(y)

Permutations / Combinations

Calculation Range and Accuracy $n \geq r$

$n\text{P}r / n\text{C}r$ $0 \leq r,\ n < 10^{10}$ (n, r: positive integer)   ±1 in the 10th digit

Ex.)

How many numbers of 4 figures can be obtained when permuting 4 different numbers among 7 (1 to 7)?

OPERATION	READ-OUT
7 SHIFT $^{nP_r}_{x}$ 4 ■	840.

How many groups of 4 nembers can be obtained when there are ten in class.

OPERATION	READ-OUT
10 SHIFT $^{nC_r}_{÷}$ 4 ■	210.

9. STATISTICAL CALCULATIONS

In statistical calculations, the various calculation results are stored in constant memories. If you have stored a value in any constant memory, it is changed after a statistical calculation. To avoid any errors, always press [SHIFT] [KAC] before performing a statistical calculation.

Means and Standard Deviation

To select the Standard Deviation mode, press [MODE] [+]. SD appears on the display.

To exit the Standard Deviation mode, select on of the other calculation modes.

Entering Data

Enter the data, and press [DATA].

Obtaining Answers

Press [SHIFT] [xσn-1] to obtain the sample standard deviation of the entered data.
Press [SHIFT] [xσn] to obtain the population standard deviation.
Press [SHIFT] [x̄] to obtain the arithmetic mean.
Press [Kout] [n] to obtain the number of data items entered.
Press [Kout] [Σx] to obtain the sum of the data items entered.
Press [Kout] [Σx²] to obtain the sum of the squares of the data.

Ex.) Find σ_{n-1}, σ_n, $\bar{x}$, n, Σx and Σx^2 based on the data 55, 54, 51, 55, 53, 53, 54, 52.

	OPERATION	READ-OUT
"SD" [SHIFT] [KAC] 55 [DATA] 54 [DATA] 51 [DATA] 55 [DATA] 53 [DATA] [DATA]		
54 [DATA] 52 [DATA]		52.
(Sample standard deviation) [SHIFT] [$x\sigma_{n-1}$]		1.407885953
(Population standard deviation) [SHIFT] [$x\sigma_n$]		1.316956719
(Arithmetic mean) [SHIFT] [$\bar{x}$]		53.375
(Number of data) [Kout] [n]		8.
(Sum of value) [Kout] [Σx]		427.
(Sum of square value) [Kout] [Σx^2]		22805.

To enter the frequency of data, use the ☒ key.

Example

The finished diameters of rods were found to be dispersed in the following manner:

Group	Median	Frequency
1	8.1	9
2	8.2	19
3	8.3	28
4	8.4	12
5	8.5	7

Obtain the standard deviation and arithmetic mean.

OPERATION	READ-OUT
MODE 3 SHIFT KAC	SD 0.
8.1 ☒ 9 DATA 8.2 ☒ 19 DATA	8.2
8.3 ☒ 28 DATA	8.3
8.4	8.4

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✖12 [DATA] 8.5 ✖7 [DATA]	8.5
Standard deviation [SHIFT][x σn]	0.11158654
Arithmetic mean [SHIFT][x̄]	8.285333333

Correcting Mistakes

Press [C] if you discover your mistake before you press [DATA]. Then enter the correct number(s). You can use [▶] to correct the last digit.

If you discover a mistake immediately after pressing [DATA], press [SHIFT][DEL]. This deletes the last piece of data that was entered.

To delete incorrect data that you entered several steps ago, enter the incorrect data again and press [SHIFT][DEL].

Example

Find n, $\bar{x}$, and σ_{n-1} based on the data: 1.2, −0.9, 2.7, 6.

	OPERATION	READ-OUT
	[MODE] 3 [SHIFT][KAC]	SD 0.
	1.3	1.3

	oops!	
	C 1.2 [DATA]	1.2
	.8 [DATA]	0.8
	oops!	
	[SHIFT] [DEL] .9 [+/-] [DATA]	−0.9
	2.8 [DATA]	2.8
	oops! — Let's correct this later!	
	6 [DATA]	6.
	2.8 [SHIFT] [DEL]	
	2.7 [DATA]	2.7
	[Kout] n	4.
	[SHIFT] $\overline{x}$	2.25
	[SHIFT] $x\sigma_{n-1}$	2.903446228

n

$\overline{x}$

σ_{n-1}

Regression Analysis

By using the linear regression formulae built into your calculator, you can do linear regression, logarithmic regression, exponential regression, and power regression.

Linear Regression

To select the Linear Regression mode, press $\boxed{\text{MODE}}\ \boxed{-}$. LR appears on the display.

Formulae:

$$B = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{n \cdot \Sigma x^2 - (\Sigma x)^2}$$

$$A = \frac{\Sigma y - B \cdot \Sigma x}{n}$$

$$r = \frac{n \cdot \Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{\{n \cdot \Sigma x^2 - (\Sigma x)^2\}\,\{n \cdot \Sigma y^2 - (\Sigma y)^2\}}}$$

Linear regression $y = A + Bx$
Logarithmic regression $y = A + B \ln x$
Exponential regression $y = Ae^{Bx}$ or $\ln y = \ln A + Bx$
Power regression $y = Ax^B$ or $\ln x = \ln A + B \ln x$

Entering Data

Enter the x data, and press [x₀,y₀]. Then, enter the y data, and press [DATA].

Obtaining Answers

Press these keys	To get these answers
[Kout] [Σx²]	Sum of the squares of x
[Kout] [Σx]	Sum of x
[Kout] [n]	Number of data
[Kout] [Σy²]	Sum of the squares of y
[Kout] [Σy]	Sum of y
[Kout] [Σxy]	Sum of the products of data
[SHIFT] [x̄]	Mean of x
[SHIFT] [xσn]	Population standard deviation of x
[SHIFT] [xσn-1]	Sample standard deviation of x
[SHIFT] [ȳ]	Mean of y
[SHIFT] [yσn]	Population standard deviation of y
[SHIFT] [yσn-1]	Sample standard deviation of y
[SHIFT] [A]	Constant term
[SHIFT] [B]	Regression coefficient

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SHIFT r	....	Correlation coefficient
SHIFT x̂	....	Estimated value x
SHIFT ŷ	....	Estimated value y

You can enter any number of data items. The calculator automatically calculates the constant term, regression coefficient, and correlation coefficient for the input data pair. It stores only these numbers in its memory. It does not store the data you input.

Ex). Results from measuring the length and temperature of a steel bar.

temp.	length
10°C	1003 mm
15	1005
20	1010
25	1008
30	1014

Find the constant term (A), regression coefficient (B), correlation coefficient (r) and estimated values $(\hat{x}, \hat{y})$ using the above figures as a basis.

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	OPERATION	READ-OUT	
"LR"	SHIFT KAC/AC 10 x₀,y₀	10.	
	1003 DATA	1003.	
	15 x₀,y₀ 1005 DATA	1005.	
	20 x₀,y₀ 1010 DATA	1010.	
	25 x₀,y₀ 1008 DATA	1008.	
	30 x₀,y₀ 1014 DATA	1014.	
	SHIFT A	998.	(A)
	SHIFT B	0.5	(B)
	SHIFT r	0.9190182776	(r)
(When the temp. is 18°C)	18 SHIFT ŷ	1007.	(mm)
(When the length is 1000 mm)	1000 SHIFT x̂	4.	(°C)

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Correcting Mistakes

If you enter an incorrect x value and catch the mistake before you press [x̄ₒ,yₒ], press [C] and enter correct value. If you have pressed [x̄ₒ,yₒ] before you catch the error, enter the correct value, press [x̄ₒ,yₒ] again, and continue.

If you enter an incorrect y value and notice it before pressing [DATA], press [C] and enter the correct value. If you enter an x and/or y value incorrectly and do not catch it before pressing [DATA], simply press [SHIFT] [DEL]. This deletes the data pair you just entered. Re-enter both x and y correctly.

If you enter several other data pairs before realizing your mistake, enter the incorrect x value, and press [x̄ₒ,yₒ]. Then, enter the incorrect y value, and press [SHIFT] [DEL]. Now, enter the correct pair.

Logarithmic Regression

When you enter the natural logarithm of the x data instead of x itself, you can calculate logarithmic regression.

To estimate the y value based on x, enter x, press [ln] and press [SHIFT] [ŷ]. To estimate the x value from y, enter y, press [SHIFT] [x̂], and then press [eˣ].

Ex).

x_i	29	50	74	103	118
y_i	1.6	23.5	38.0	46.4	48.9

Find A, B, r, $\hat{x}$ and $\hat{y}$ using the above figures as a basis.

	OPERATION	READ-OUT
"LR"	SHIFT KAC 29 ln x_b, y_b	3.36729583
	1.6 DATA	1.6
	50 ln x_b, y_b 23.5 DATA	23.5
	74 ln x_b, y_b 38 DATA	38.
	103 ln x_b, y_b 46.4 DATA	46.4
	118 ln x_b, y_b 48.9 DATA	48.9
	SHIFT A	−111.1283976	(A)
	SHIFT B	34.02014749	(B)
	SHIFT r	0.9940139464	(r)
(When x_i is 80)	80 ln SHIFT $\hat{y}$	37.94879482	($\hat{y}$)
(When y_i is 73)	73 SHIFT $\hat{x}$ SHIFT e^x	224.1541314	($\hat{x}$)

Exponential Regression

Input the y data as the natural logarithm of the actual data y to calculate exponential regression. To obtain coefficient A, press [SHIFT] [A] [SHIFT] [e^x], To estimate the y value based on x, enter x, press [SHIFT] [y] then press [e^x]. To estimate the value of x based on y, enter y, press [ln], and press [SHIFT] [x].

Ex).

xi	6.9	12.9	19.8	26.7	35.1
yi	21.4	15.7	12.1	8.5	5.2

Find A, B, r, $\hat{x}$ and $\hat{y}$ using the above figures as a basis.

	OPERATION	READ-OUT
"LR"	[SHIFT] [KAC / AC] 6.9 [x_D, y_D]	6.9
	21.4 [ln] [DATA]	3.063390922
	12.9 [x_D, y_D] 15.7 [ln] [DATA]	2.753660712
	19.8 [x_D, y_D] 12.1 [ln] [DATA]	2.493205453
	26.7 [x_D, y_D] 8.5 [ln] [DATA]	2.140066163

$$35.1 \boxed{x_{0,y_0}} 5.2 \boxed{\text{In}} \boxed{\text{DATA}}$$

	1.648658626	
$\boxed{\text{SHIFT}} \boxed{A} \boxed{\text{SHIFT}} \boxed{e^x}$	30.49758742	(A)
$\boxed{\text{SHIFT}} \boxed{B}$	−0.04920370831	(B)
$\boxed{\text{SHIFT}} \boxed{r}$	−0.9972473519	(r)
(When xi is 16) $16 \boxed{\text{SHIFT}} \boxed{\hat{y}} \boxed{\text{SHIFT}} \boxed{e^x}$	13.87915739	($\hat{y}$)
(When yi is 20) $20 \boxed{\text{In}} \boxed{\text{SHIFT}} \boxed{\hat{x}}$	8.574868046	($\hat{x}$)

Power Regression

For power regression calculation, input the natural logarithm of both the x and y data.
To obtain coefficient A, press $\boxed{\text{SHIFT}} \boxed{A} \boxed{\text{SHIFT}} \boxed{e^x}$. To estimate the y value based on x, enter x,
press $\boxed{\text{In}}$, and press $\boxed{\text{SHIFT}} \boxed{\hat{y}} \boxed{\text{SHIFT}} \boxed{e^x}$. To estimate the x value based on y, enter y, press $\boxed{\text{In}}$,
and press $\boxed{\text{SHIFT}} \boxed{\hat{x}} \boxed{\text{SHIFT}} \boxed{e^x}$.

Ex).

xi	28	30	33	35	38
yi	2410	3033	3895	4491	5717

Find A, B, r, $\hat{x}$ and $\hat{y}$ using the above figures as a basis.

	OPERATION	READ-OUT	
"LR"	[SHIFT] [KAC] 28 [In] [xo,yo]	3.33220451	
	2410 [In] [DATA]	7.787382026	
	30 [In] [xo,yo] 3033 [In] [DATA]	8.017307508	
	33 [In] [xo,yo] 3895 [In] [DATA]	8.267448958	
	35 [In] [xo,yo] 4491 [In] [DATA]	8.409830673	
	38 [In] [xo,yo] 5717 [In] [DATA]	8.651199471	
	[SHIFT] [A] [SHIFT] [eˣ]	0.2388010922	(A)
	[SHIFT] [B]	2.771861638	(B)
	[SHIFT] [r]	0.9989062545	(r)
(When xi is 40)	40 [In] [SHIFT] [ŷ] [SHIFT] [eˣ]	6587.67477	($\hat{y}$)
(When yi is 1000)	1000 [In] [SHIFT] [x̂] [SHIFT] [eˣ]	20.26225651	($\hat{x}$)

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Gamma Function

To select the COMP mode, press [MODE] [1].

Calculation Range:

$$-10^{10} < x \leq 70.95757445$$

± 1 in the 10th digit

EXAMPLE	OPERATION	READ-OUT
$\Gamma(5) = 24$	5 [T]	24.
$\Gamma(2.5) = 1.329340388$	2.5 [T]	1.329340388
$\Gamma(-5.6) = 9.582963624 \times 10^{-3}$	5.6 [+/-] [T]	9.582963624^{-03}

Chi Square Distribution

The probability distribution function for the chi square distribution in which the freedom degree is n is:

$$f(x) = \frac{1}{2^{n/2} \cdot \Gamma\ (n/2)} \cdot x^{(n/2)-1}\, e^{-x/2}$$

Determine $f(x)$ when $x = 8.1$ and $n = 4$.

2 $\boxed{x^y}$ $\boxed{(\,}$ 4 $\boxed{\div}$ 2 $\boxed{)\,}$ $\boxed{\text{Min}}$ $\boxed{\times}$ $\boxed{\text{MR}}$ $\boxed{\Gamma}$ $\boxed{=}$ $\boxed{\text{SHIFT}}$ $\boxed{1/x}$ ..... 0.25 $\left(\dfrac{1}{2^{n/2} \cdot \Gamma\ (n/2)} \right)$

$\boxed{\times}$ 8.1 $\boxed{x^y}$ $\boxed{(\,}$ $\boxed{\text{MR}}$ $\boxed{-}$ 1 $\boxed{)\,}$ $\boxed{\times}$ $\boxed{(\,}$ 8.1 $\boxed{+/-}$ $\boxed{\div}$ 2 $\boxed{)\,}$ $\boxed{\text{SHIFT}}$ $\boxed{e^x}$ $\boxed{=}$ 0.03528030864

■ CALCULATOR REGISTERS

This section explains why the incorrect result under "Correcting Mistakes" was reached.

Your calculator has seven internal memories, called **registers**.

They are:

X register (Display)
Y (L₁) register (arithmetic operations)
L₂ through L₆ registers

These are the operation registers. For normal arithmetic and function calculations, the X and Y registers are used. The value in the X register is always on the display. The Y register contains the pending portion of a calculation. This portion is not displayed. For example, when you press 4 ✖ 6, the number 6 is displayed. (It is in the X register.) The value 4 is held as a pending value in the Y register. If you now press ▬, the operation is completed. The display shows 24, and the Y register contains zero. You can swap the X and Y registers by pressing ⌈x↔y⌉.

When the problem includes nested parentheses or requires the judgment of the precedence of multiplication/division and addition/subtraction, there can be more than one pending operation. In this case, the L₂—L₆ registers are used in addition to the X and Y registers.

When there is a pending operation of higher priority, be it multiplication over addition or parentheses over multiplication, the calculator pushes the pending operation (of lesser priority) from the Y register into the L_2 register. It then pushes the contents of the L_2 register into the L_3 register, and so on. The calculator then performs the higher-priority calculation first, using only the X and Y registers. When this operation finishes, the calculator pops the pending operation from the L_2 register back into the Y register, the L_3 register into L_2, and so on, and proceeds. The more nesting, the more registers are used. There are six L registers, so up to six levels of nesting are possible on your calculator.

When you mistakenly enter ▬ instead of ✕ , because the ▬ has same priority level as ✚ , the calculator performs the addition first (7). Then, it waits for input of the value to be subtracted. The addition having already been done, the multiplier is applied to the result of addition ($7 \times 5 = 35$), instead of to the value 4 ($4 \times 5 + 3 = 23$).

■ MAINTENANCE

Keep it dry. If water should get on it, wipe it off immediately. Water contains minerals that can corrode electronic circuits.

Do not store in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and can even distort or melt certain plastics.

Do not drop your product. This will likely result in failure to operate. Circuit boards can crack and cases may not survive the impact. Handling your product roughly will shorten its useful life.

Do not use or store in areas of high levels of dirt or dust. The electronics may be contaminated. Any moving parts will wear prematurely.

Do not use harsh chemicals, cleaning solvents or strong detergents to keep your unit looking new. You need only wipe it with a dampened cloth from time to time.

■ SPECIFICATIONS

■ Basic features
- **Basic operarions:** 4 basic calculations for $+/-/\times/\div/x^y/x^{1/y}$, and parenthesis calculations.
- **Built-in functions:** Trigonometric/inverse trigonometric functions (angular units: degrees, radians, grads), logarithmic/exponential functions, hyperbolic/inverse hyperbolic functions, powers, roots, square roots, squares, reciprocals, cube roots, coordinate conversions, decimal-sexagesimal conversions, pi, percentages, permutations, combinations, random numbers, gamma function, ENG calculations, UNIT calculations, binary/octal/decimal/hexadecimal calculations, logical operations, complex number calculations
- **Statistical calculation functions:** Standard deviation — number of data, sums, sum of squares, mean, standard deviation
  Linear regression — number of data, sum of x, sum of y, sum of squares of x, sum of squares of y, mean of x, mean of y, standard deviation of x, standard deviation of y, constant term, regression coefficient, correlation coefficient
- **Memory:** 1 independent memory and 6 constant memories.

■ Decimal point:
Full floating with underflow.

■ Read-out:
Liquid crystal display.

■ Power consumption:
0.006 W

■ Power source:
Two lithium batteries (Type: CR2032 Cat. No. 23-162).
The unit gives approximately 350 hours continuous operation on type CR2032.

■ Auto power-off:
Approximately 6 minutes after last key operation

■ Ambient temperature range:
32°F — 104°F (0°C — 40°C)

■ Dimensions:
$3/8$"H × $2^7/8$"W × $5^1/8$"D (9.2H × 72W × 131mmD)

■ Weight:
3.1 oz (88g) including batteries

■ KEY INDEX

90

%

=

- Equal key
- Percent key 25

R→P

+

- Addition key
- Rectangular to polar key 64

P→R

−

- Subtraction key
- Polar to rectangular key 65

nPr

×

- Multiplication key
- Permatation key 66
- √•Statistical calculation key
  (Estimated value x) 74

nCr

÷

- Division key
- Combination key 66
- √•Statistical calculation key
  (Estimated value y) 74

RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 1 year from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

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We Service What We Sell

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